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## A Review on the Present State of Fish Cage Culture in the Baram District of Sarawak

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The fish cages presently used in the Baram District are cylindrical in shape and made of bamboo and rattan. The origin and construction of these cages are illustrated (Fig. 1, 2 & 3). Their function is only to transport live wild fish from the countryside to the commercial centers and no feed is provided for the fish. Rough handling leads to a high mortality rate during and after capture. Most of the fishing is done part-time by local farmers and interest in improving the present methods is low. The problems which block the development of serious fish cage culturalists are discussed.

### Origin and Construction of Local Fish Cages

The local type of cylindrical fish cage is built from jungle products including a thick type of bamboo known locally as 'Buloh Perin', rattan and a jungle creeper known as 'Ridan' (*Salacca glabrescens*). These are essentially the same materials which go into the construction of the traditional live-fish traps which were used extensively before more modern gear became available. Gill nets and lift nets have become popular in the last twenty years.

Since the construction of both traps and cages is quite similar, it seems likely that the bamboo fish cages are an adaptation of the original fish traps and have probably been developed within the last 50 years or so to transport market fish from the countryside to the region's major commercial center. The development of cages to transport live fish rather than the distribution of locally processed products such as salted, smoked, or fermented fish which would be more convenient to transport is probably a result of the preference of the Chinese majority found in the commercial centers. The Chinese community generally prefers fresh fish and the concoctions produced by salting and smoking techniques where there is no quality control has not encouraged a market for the natives' processed products.

The average size for the local cages is about 12 feet (4 m) long with a diameter of about 4 feet (1.3 m) but there is quite a wide range in sizes. Cage slats are made from bamboo which is split and planed with a knife to a width of about 1 inch (2.5 cm). The slats are bound together into a long mat with rattan string (see Figure 1) at about 18 inch (0.5 m) intervals, and beginning about the same interval from each end. The space between the slats is about 1/2 inch (1.25 cm). Support hoops are made to the desired diameter from 'Ridan' or, if it is not available, from rattan as well, a cage of 12 feet (4 m) long has about four internal support hoops one at each end and two spaced evenly through the body. The end hoops are first covered with bamboo slats which are tied as shown in Figure 2a and 2b.

When the cage is to be erected the bamboo mat is tied around the outside of the support hoops using the same method as shown in Figure 2. A rectangular gap is cut in the middle section of some of the last slats in the mat to act as an entrance to the completed cage (Figure 3) when the mat is tied to the hoops. The finished cage is floated between two large hollow bamboo tubes tied to its side.

### Distribution of the Local Fish Cages

Throughout most of the Baram District fish are captured in too small quantities to have stimulated the development of the large bamboo cages described above. However, small 'paper-box' sized cages made from wood or bamboo can often be seen attached to the floating river bath-houses for holding prawns and the occasional fish for dinner. The usage of large cages has been mainly restricted within Sarawak to the peoples of the lower Tinjar River, Logan Bunut, and to some places on the lower Baram River where commercial quantities of fish may be available.

Almost none of the people harvesting fish could be considered full-time fishermen, or even that fishing is their major occupation. Most of them are paddy or rubber farmers who came to fish on a large scale only when the water conditions are suitable.

### Operation of the Cages

As part of their customary rights all long-house people in the Baram District, and throughout Sarawak as a whole, are free to fish exclusively in the rivers and streams within their tribal territory so long as they do not employ prohibited fishing methods, especially poisons. These fishing rights are particularly valuable in the lower Tinjar - Loagan Bunut area and the oxbow lakes of the mid-Baram River where the best fishing grounds are to be found. Of these two localities only the Tinjar-Bunut area produces commercial quantities of fish, through a limited supply of less than 10 metric tons per year. The species which compose the bulk of these sales are Mengalan (*Puntius Bulu*), Kachong (*Puntius bra-moides*), Mata Merah (*Osteochilus melanopleura*), Tapah (*Wallago maculatus*), Baung (*Mystus* and *Arius* sp.) Betutu (*Oxyeleotris marmorata*), Belida (*Notopterus notopterus*), and Biawan (*Helostoma temminckii*) with Biawan probably making up the largest proportion.

Those fish collected by the lift net fishermen are usually raked across the coarse nets and dumped into the cages. The rough handling causes many scales of the cyprinids to be rubbed away, and often the gill covers as well, which leads to immediate death for some delicate individuals and leaves others open to fungal and bacterial infections. The spines of catfish are usually broken to minimize personal injury during later handling before they are thrown into the cages and any fish which are too small in size to bother with may be pulled through the netting and thrown into the river where most will die from their injuries. The manner of collection and handling leads to a very high mortality rate among the captured fish especially among the more delicate species. If the fishermen has time he may salt the dead or sent them for sale to the nearest long-house or timber camp. Otherwise, the dead fish may be simply thrown back to the river.

No feeding of the caged fish takes place so the system is not really a method of fish culture but simply a holding facility until the fish can be sent to market. The time span between capture and marketing may often be as long as one month during which time dead fish must be constantly removed.

Most of the deaths can be originally attributed to rough handling and the onset of disease in crowded circumstances complicated by acute starvation. Most of the fishermen realize that the fish ought to be fed but as yet they have found it too bothersome to do so.

When the cages are full or the fishing season has ended they will be floated down to the long-houses where the Chinese fishmongers from Marudi of Lubok Nibong will come to buy. Those fishermen who wish to get a better price for their catch will often float the cages down to Marudi and sell to the fishmongers or restaurants there at a higher price. When the fish have been sold the cages may be sold as well, for a small price, or the fishermen may dismantle them and carry them home for reuse.

### Discussion

Fish cages as they are used in the Barm District is not a culture system but a method of holding and transporting wild captured fish to the market centers, mainly Marudi.

The fishermen have been encouraged to handle the fish more gently during capture, to feed the market-sized fish in the cages to help them maintain their weight and condition, and to feed smaller individuals captured in permanent cages or ponds until they reach a marketable size. Maintaining permanent cages would also help them to space out their fish sales to stabilize the present cycle of high and low supplies and prices. However, most of the people are not full-time fishermen but are poor farmers who are generally more interested in a quick cash turnover rather than the creation of a permanent business even though they acknowledge the plausibility of a full-time fish capture-culture industry.

There are a number of critical points which must be considered before such an industry could be initiated:

- 1) From experiments done with bamboo cages by the Sarawak Fisheries Division, the type now in use in the Tinjar-Bunut area would not last more than a year in the water — the rattan binding not within 3 months although this could be replaced by nylon rope — and are too small for serious cage culture purpose. Larger cages made from bamboo are not feasible because of its poor durability and strength so a switch to ones made from hard-woods or nylon netting would be required. The capital costs of such materials is prohibitive given the income of the average native family.

2) Attempts to organize the area's fishermen into a co-operative have failed because of their general lack of serious interest and their distinct inability to co-operate due to long standing intra-longhouse and inter-tribal rivalries. They would prefer to deal individually with the Chinese fishmongers from Marudi than each other, and indeed the history of co-operatives in the area is not encouraging.

3) The high degree of boat and timber-log traffic on the rivers could easily reduce a man's investment in time and cages to a smashed heap in a very few minutes and the severe water level fluctuations can lead to beaching of the cages or their being washed away or damaged by floods and flood-borne debris.

4) Perhaps the most important point at this time is that no one has physically demonstrated that cage culture in their area, or anywhere else in Sarawak for that matter, is a practical and economically viable venture. Until this problem is broached few local fishermen are likely to show more than a passing interest in fish cage culture.

5) Unreliable supply of fish fingerlings for stocking cages, from the rivers.

In place of the rivers, the oxbow lakes have been suggested as possible areas for the sitting of cages but the only problem which would be allevia-

ted is the interference from boat and timber-log traffic. However, two further problems would be added:

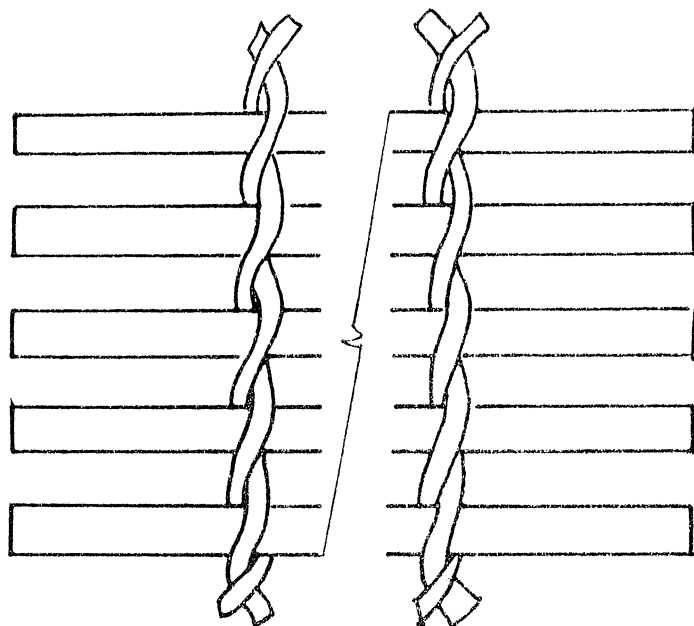
1) Most of the oxbow lakes are presently uninhabited and no people are as yet willing to move there simply for the purposes of fish cage culture.

2) The lakes are generally small, usually under 5 acres, and tend to become shallow and anoxic during extended drought periods of 2 to 3 weeks. One lake, Loagan Bunut, dries up completely.

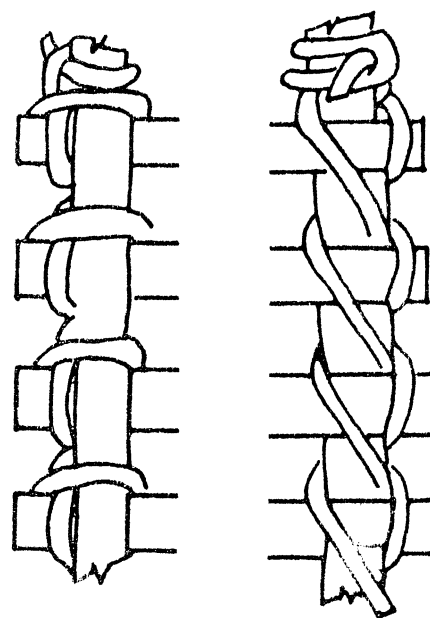
The only oxbow lakes where cage culture might be feasible, if the people should become receptive to the idea, are Terikan, Titadd, Tujoh and Ekang.

Outside of the Marudi/Long Teru/Long Lama triangle in the Baram District fish cages could not be seriously considered even as a subsistence fish culture alternative because of the timber-log traffic and the torrential state of the rivers.

All things considered it is not surprising that the state of the cage culture art in the district is still in such a primitive condition, and it is likely to remain so without any significant change within the foreseeable future despite its theoretical potential. Before any serious interest in improvements can be generated among the people, a practical and economically viable fish cage operation will have to be demonstrated to them.



**Fig. 1. Construction of the bamboo and rattan mat for the outer covering of the fish cage.**



**a) Inside View**

**b) Outside View**

**Fig. 2. Method of tying the bamboo slats to the support hoops.**



**Fig. 3. The completed fish cage.**